Polynomial long Division

Divide ① $x^2+3x-12$ by $x-3$

$$x-3\overline{)\,x^2+3x-12}\qquad x+6\ R\,6$$

$$\begin{array}{r} x^2+3x \\ \hline 6x-12 \\ 6x-18 \\ \hline 6 \end{array}$$

Check by $(x-3)(x+6)+6 = x^2+3x-12$

② Determine whether $x+4$ is a factor of x^2+6x+8 and x^3+3x^2-6x-7

$$x+4\overline{)\,x^2+6x+8}\qquad x+2$$

$$\begin{array}{r} x^2+4x \\ \hline 2x+8 \\ 2x+8 \\ \hline 0 \end{array}$$

Yes!

$$x+4\overline{)\,x^3+3x^2-6x-7}\qquad x^2-x-2$$

$$\begin{array}{r} x^3+4x^2 \\ \hline -x^2-6x \\ -x^2-4x \\ \hline -2x-7 \\ -2x-8 \\ \hline 1 \end{array}$$

NO!

You try: $2x^2-19x+24 \div x-8$

$$x-8\overline{)\,2x^2-19x+24}\qquad 2x-3$$

$$\begin{array}{r} 2x^2-16x \\ \hline -3x+24 \\ -3x+24 \\ \hline 0 \end{array}$$

Synthetic division must be in standard form

① $3x^3-4x^2+2x-1 \div x+1$

$x+1 \overline{)3x^3-4x^2+2x-1}$

$$\begin{array}{r|cccc} -1 & 3 & -4 & 2 & -1 \\ & & -3 & 7 & -9 \\ \hline & 3x^2 & -7x & 9 & -10 \end{array}$$

mult. $-1 \cdot 3$
add $-4+-3$

-10 ↑ R

② $x+1 \overline{)x^3+4x^2+x-6}$

$$\begin{array}{r|cccc} -1 & 1 & 4 & 1 & -6 \\ & & -1 & -3 & 3 \\ \hline & 1 & 3 & -2 & -3 \end{array}$$

x^2+3x-2 R -3 ↑ R

3 $-x^3-7x^2-7x+20 \div x+4$

talk about standard form

$$\begin{array}{r|cccc} -4 & 1 & -7 & -7 & 20 \\ & & -4 & 44 & -148 \\ \hline & 1 & -11 & 37 & -128 \end{array}$$

you try $x^3+27 \div x+3$

$$\begin{array}{r|cccc} -3 & 1 & 0 & 0 & 27 \\ & & -3 & 9 & -27 \\ \hline & 1 & -3 & 9 & 0 \end{array}$$

x^2-3x+9